Treatment PRINCIPLES

WATER TREATMENT PLANT PRINCIPLES

Wide Bay Water maintains and operates four water treatment plants – Howard, Burgowan, Teddington and Tiaro water treatment plants. All water treatment plants must hold a Development Approval (Environmental Licence) that contains specific conditions that the treatment plant must meet in protecting the environment. Legislation introduced by the Queensland Government has made it mandatory for water suppliers to have risk-based quality management plans in place to protect the public from drinking unsafe water. WBW is one of the first water suppliers in Queensland that has implemented the HACCP (Hazard Analysis Critical Control Point) system for all our water treatment plants.

The most widely applied water treatment process – known as conventional treatment – is a combination of coagulation, flocculation, sedimentation, filtration and disinfection.

COAGULATION

Coagulation is the process of using chemicals to clump very fine particles into larger particles. This clumping makes it easier to separate the solids from the water by settling, skimming, draining and/or filtering. Generally there are two key steps in coagulation:

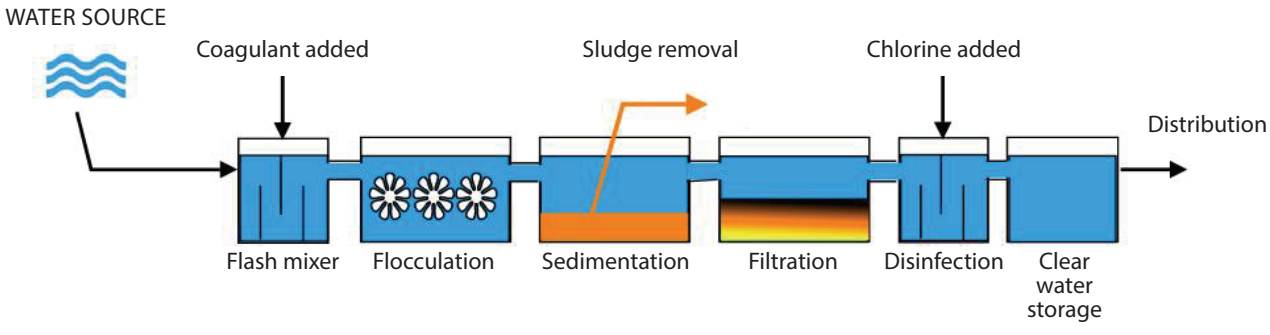
- initial screening and
- adding coagulant.

INITIAL SCREENING

Raw (untreated) water is withdrawn from a surface water supply (such as Lake Lenthall, Mary River or Tinana Creek). The water is pumped to a central treatment plant as described above. It is screened to remove coarse solids like weeds and other debris. What remain are finer suspended solids like clay particles.

The particles that remain after the initial screening are extremely small and take time to settle. To assist settling, a coagulant is added to the water. The chemical coagulant causes these particles to be attracted to each other to form larger particles of 'floc'. These larger particles settle more quickly. Chemicals commonly used in coagulation at our plants are Liquid Alum or Aluminium Chlorohydrate.

Commonly, the coagulation tank is agitated as the coagulant is added. This encourages the water and coagulant to mix thoroughly. This technique is called 'Flash Mixing'.



Conventional treatment

FLOCCULATION

Once the coagulant is mixed in the water, the flocculation process begins. During this stage the water is gently passed through the flocculation tanks. The flocculation tanks use hydraulic or mechanical methods to encourage the particles to collide with other particles in the water to create a floc. Hydraulic flocculation tanks have a series of horizontal or vertical baffles. Mechanical flocculation tanks use reels, turbines or propellers to encourage the smaller floc from the flash mixer to bind with the floc.

As the small floc moves through the tank it collides with other small floc to create larger heavier floc particles. At this point chemical flocculants are added and the water is gently mixed to help the floc grow in size. The most common flocculant is a polymer. Also at this stage lime or soda ash may be added to treat the hardness of the water.

Once the coagulation and flocculation process is complete, the floc is ready to be taken out. Removal of the floc occurs in the sedimentation and clarification process.

SEDIMENTATION

The main aim of sedimentation is to remove colloids and reduce turbidity. The velocity of the water through the sedimentation tanks is a key operating measure. It is directly related to the amount of time the water spends in the sedimentation tank. Having effective coagulation and flocculation processes will help ensure the sedimentation and clarification processes are effective.

A basic sedimentation process involves a simple sedimentation tank. Flow enters from one side of the tank. As the water passes through the tank the floc settles on the bottom of the tank to form sludge. Chain driven scrapers are used to direct the sludge to a draw-off point. The sludge is collected in a hopper at the end of the tank where it is removed by screw conveyors or pumped out.

Some plants dewater the sludge with a mechanical belt filter press and send the water back to the head of the plant. Others direct the sludge to lagoons where the water evaporates leaving dried sludge.

SLUDGE BLANKET CLARIFIERS

One form of sedimentation process uses some form of upward flow settlement tank. These tanks are generally circular. Flow enters the bottom of the tank. The water passes through the zone of suspended sludge expanding it to form a thinc layer or 'blanket'. Clear water passes through the blanket and overflows into decanting channels. Sludge continuously enters a central hopper where it is bled from the tank.

FILTRATION

After separating most of the floc, the water is filtered as the final step in removing the remaining suspended particles and unsettled floc. Filters are classified as either slow or rapid. They can be operated using gravity or by pressure. The most common type of filter is a rapid sand filter.

RAPID MEDIA FILTER

In a typical rapid media filter water moves vertically through sand. There is also a layer of activated carbon or anthracite coal above the sand. The top layer removes organic compounds that can cause dangerous disinfection by-products and those with taste and odour problems. The space between sand particles is larger than the smallest suspended particles so most particles pass through the surface layers and are trapped in spaces or adhere to sand particles.

DISINFECTION

Water is a universal solvent that can transport a wide range of dissolved materials and suspended particles. This includes biological organisms (pathogens). The disinfection process is designed to make potable water safe for human consumption. To improve the quality and usability of the treated water it is disinfected as the last stage of the treatment process. There are three main types of disinfection methods available:

- OZONE has powerful disinfection properties but no lasting effect to protect the water once it enters the distribution system.
- ULTRAVIOLET RADIATION is used widely in small plants but like Ozone has no lasting effect.
- CHLORINATION is not as powerful as Ozone but it has a lasting effect that limits bacterial growth in the distribution network.